CLAIMS

I claim:

1. A UPnP interface device that is configured to facilitate UPnP control of at least one non-UPnP device that are located on one or more slave networks using one or more different network

5   technologies, comprising:

      an IP interface to at least one UPnP controller, the UPnP controller being configured to issue a UPnP command in conformance with a UPnP protocol,

        at least one non-IP interface to the at least one non-UPnP device, and

        a processor that is configured to:

10   receive the UPnP command, via the IP interface,

            transform the UPnP command into a device command,

            communicate the device command to a target device of the at least one non-UPnP device via the at least one non-IP interface, and

            communicate a UPnP acknowledgement of the UPnP command to the at least one

15   UPnP controller, via the IP interface, and

2. The device of claim 1, wherein the one or more network technologies include at least one of: a USB network, a bluetooth network, a HAVi-compatible network, an IEEE 1394 network, a Home API network, a HomeRF network, a Firefly network, a power line network, an X-10

20   network, and a Jini-compatible network.

3. The device of claim 1, wherein:

      the UPnP controller is further configured to issue a UPnP request in conformance with the UPnP protocol,

25   the UPnP request includes one of: a description request, a presentation request, a subscription request, and a query, and

      the processor is configured to provide at least one of: a device description, a service description, a presentation page, an event, and a value of a variable, in response to the UPnP request.

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4. The device of claim 3, wherein

the IP interface also provides access to a file server, and

the processor provides the at least one of: the device description, a service description, a presentation page, an event, and a value of a variable, based on information received from the

5   file server.

5. The device of claim 1, wherein

the processor includes at least one of:

a discovery module that is configured to provide an advertisement of the at least

10   one non-UPnP device to the UPnP controller,

a description module that is configured to provide a description of functions of

the at least one non-UPnP device to the UPnP controller, in response to a request from the UPnP

controller, and

a presentation module that is configured to provide a presentation page that

15   facilitates a control of the at least one non-UPnP device by a user.

6. The device of claim 5, wherein

at least one of the discovery module, the description module, and the presentation module

is configured to provide the advertisement, the description, and the presentation page,

20   respectively, for the at least one non-UPnP device of the slave networks.

7. The device of claim 1, wherein

the processor includes at least one of:

a service control module that communicates commands to the target device,

25   an event subscription module that receives requests from the at least one UPnP

controller to be notified of one or more changes of state of the target device, and

an event source module that notifies the at least one UPnP controller of one or

more changes of state of the target device.

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8. The device of claim 7, wherein

the service control module maintains a service state table that reflects the state of the target device, and

the event source module notifies the at least one UPnP controller of the one or more changes of the state of the target device based on the service state table.

9. The device of claim 1, wherein the UPnP server enabler communicates the device command to the target command by modifying a data structure that is associated with a thread, and the thread effects the communication to the at least one non-UPnP device of the slave networks.

10. The device of claim 1, wherein

the IP interface also provides access to a file server, and

the processor effects the transform of the UPnP command into the device commands based on information received from the file server.

11. The device of claim 1, wherein

the processor is further configured to recognize a connection and disconnection of the at least one non-UPnP device, and initiates and terminates threads in response to each connection and disconnection, respectively.

12. A method for facilitating UPnP control of at least one non-UPnP device on a slave network, comprising:

    receiving device-dependent data corresponding to each of the at least one non-UPnP device from a file server,

5   receiving a UPnP command in conformance with a UPnP protocol from a UPnP controller,

    transforming the UPnP command into a device command, based on the device-dependent data received from the file server,

    communicating the device command to a target device of the at least one non-UPnP

10   device on the slave network, and

    communicating a UPnP acknowledgement of the UPnP command to the UPnP controller.

13. The method of claim 12, wherein the slave network is one of: a USB network, a bluetooth network, a HAVi-compatible network, an IEEE 1394 network, a Home API network, a HomeRF

15   network, a Firefly network, a power line network, an X-10 network, and a Jini-compatible network.

14. The method of claim 12, further including:

    receiving a UPnP request in conformance with the UPnP protocol,

20   the UPnP request including one of: a description request, a presentation request, a subscription request, and a query, and

    providing at least one of: a device description, a service description, a presentation page, an event, and a value of a variable, in response to the UPnP request, based on information received from the file server.

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15. The method of claim 12, further including at least one of:

   providing an advertisement of at least one non-UPnP device to the UPnP controller,

   providing a description of functions of the at least one non-UPnP device to the UPnP controller, in response to a request from the UPnP controller, and

   providing a presentation page that facilitates a control of the at least one non-UPnP device by a user.

16. The method of claim 15, wherein

   at least one of the advertisement, the description, and the presentation page are provided by the file server.

17. The method of claim 12, further including

   receiving requests from the UPnP controller to be notified of one or more changes of state of the at least one non-UPnP device, and

   notifying the UPnP controller of one or more changes of state of the at least one non-UPnP device.

18. The method of claim 17, further including

   maintaining a service state table that reflects the state of the target device, and

   notifying the UPnP controller of the one or more changes of the state of the at least one non-UPnP device based on the service state table.

19. The method of claim 12, further including

   creating a thread that is associated with the at least one non-UPnP device of the slave network, and

   modifying a data structure that is associated with the thread; and

   wherein the thread is configured to effect the communication of the device command to the at least one non-UPnP device of the slave network, based on the modification of the data structure.

20. A network comprising:

an IP sub-network,

a non-IP sub-network, and

a UPnP enabling device that facilitates control of a device on the non-IP sub-network by

5   a UPnP controller on the IP sub-network.

21. The network of claim 20, further including

a file server on the IP sub-network, and

wherein

10   the UPnP enabling device facilitates the control of the device based on information

received from the file server.

22. The network of claim 20, wherein

the UPnP enabling device is configured to:

15   receive a UPnP command from the UPnP controller on the IP network,

transform the UPnP command into a device command, and

communicating the device command to the device on the non-IP sub-network.

23. The network of claim 22, wherein

20   the UPnP enabling device is further configured to provide at least one of: a device

description, a service description, a presentation page, an event, and a value of a variable

corresponding to the device on the non-IP network, in response to a UPnP request from the

UPnP controller.

25   24. The network of claim 23, further including

a file server on the IP sub-network, and

wherein

the UPnP enabling device provides the at least one of: the device description, the service

description, the presentation page, the event, and the value of the variable, based on information

30   received from the file server.

25. The network of claim 20, wherein

the UPnP enabling device facilitates the control of the device on the non-IP sub-network by a UPnP controller on the IP sub-network via the use of threads that provide a non-blocking communication.

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